Assessment and Assurance of Microelectronics Packaging Technology of Microelectromechanical Systems (MEMS)

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Microelectromechanical systems (**MEMS**) have shown a significant promise in the last decade for a variety of applications such as air-bag, pressure sensors, accelerometer, microgyro, etc. Standard semiconductor microelectronics packaging needs the integrated circuits to be protected from the harsh environment, and provide electrical communication with the other parts of the circuit, facilitate thermal dissipation efficiently, and impart mechanical strength to the silicon die. Microelectronics packaging involves wafer dicing, bonding, lead attachment, encapsulation to protect from the environment, electrical integrity, and package leak tests to assure the **packaging** technology.

In the case of MEMS the microstructures (active elements) often interfaces with the hostile environment where packaging leak tests and testing of such devices using chemical and mechanical parameters will be very difficult and expensive. Packaging of MEMS is significantly complex as they serve to protect from the environment and microstructures interact with the same environment to measure or affect the desired physical or chemical parameters. The most of the silicon circuitry is sensitive to temperature, moisture, magnetic field, light, and electromagnetic interference. The package must then protect the on-board silicon circuitry while simultaneously exposing the microsensor to the effect it measures to assure the MEMS technology by lowering the risk to zero. MEMS technology has a major application in developing a microspacecraft for space systems provided assurance of MEMS technology is sufficiently addressed non-destructively. This technology would eventually miniaturize many of the components of the spacecraft to reach the NASA's safety and mission assurance goal by building faster, cheaper, better, smaller spacecraft to explore the space more effectively by teaming-up with the other NASA centers using the limited resources available. This paper discusses the latest developments in the MEMS technology and challenging issues in the packaging of hermetically sealed and non-hermetically sealed MEMS sensor devices based on silicon, poly-silicon, and other materials for microspacecraft applications considering the space environment and reliability assurance qualification guidelines in perspective.

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